## §4. Development of High Performance Catalyst for Oxidation of Tritium in Gaseous Phase

Munakata, K., Koga, A., Kanjo, S., Yokoyama, Y., Ianovski, D. (Interdisciplinary Graduate School of Engineering Sciences Kyushu University), Asakura, Y., Uda, T.

Monitoring of tritium in the environment is a key technique to confirm the safety of the fusion technology and the fusion reactor. The catalytic oxidation and adsorption is a conventional method for monitoring of tritium released to the environment. For tritium monitoring, it is required to recover tritium, tritiated water and tritiated methane separately. For this purpose, the catalyst used needs to have a special performance, which enables the selective oxidation of tritium and tritiated methane and the recovery of tritiated water into the catalyst itself. The catalytic oxidation and adsorption is also the most conventional and reliable method for removing tritium that is accidentally released into the working area of fusion power plants. This time, the authors tried to improve the oxidation performance of catalysts used for these purposes.

In our previous works, several fabrication techniques were tested to develop the catalyst with A-type zeolite substrates. As a result, the authors found a special technique to prepare such a noble metal catalyst. With regard to this catalyst, it was found that the catalyst has high performance for the oxidation hydrogen and for selective oxidation of tritium in the coexistence of tritiated methane. In this work, catalysts with different contents of noble metals were prepared using the developed technique and their catalytic performances were tested. Furthermore, the catalytic activity of metal honeycomb catalyst was also investigated.

The experiments were performed using a packed bed reactor. About 1 g of each catalyst was placed in the reactor. An Argon gas containing ~1000 ppm of $H_2$, ~1000 ppm of $CH_4$ and ~20 % of $O_2$ was introduced to the reactor. The values of SV (reciprocal of residence time) range from 17,000 to 22,000 $h^{-1}$; each catalyst was tested under the almost same condition. The temperature of the reactor was raised stepwise from ambient temperature to 400 °C. At each temperature, the conversions of $H_2$ and $CH_4$ were measured under steady state conditions.

Figure 1 shows the conversions of $H_2$ and $CH_4$ over the 2%Pt/MS3A catalyst. $H_2$ was almost completely oxidized at 200 °C over the catalyst. The conversion of $CH_4$ was 25 % even at 400 °C over this catalyst. Closed symbols in Fig. 2 show the results for the 0.5%Pt/MS3A catalysts. Comparison of these results suggests that the oxidation performance of hydrogen cannot be improved even if the Pt content is increased. It is also indicated that the selectivity for selective oxidation of hydrogen and methane becomes worse when the Pt content is increased. Open symbols in Fig. 2 show the conversions of hydrogen and methane over the 0.5%Pt/MS3A catalyst in the presence of water vapor (6100 ppm). This result reveals that the catalytic activity for the oxidation of hydrogen decreases if water vapor is coexistent. Figure 3 shows the conversions over the metal honeycomb catalyst deposited with Pd. Its oxidation performance is not so high in spite of the low SV value, which suggests that the metal honeycomb is not suitable for oxidation catalysts.

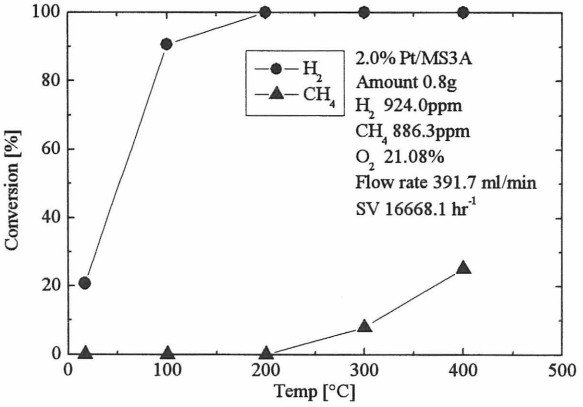


Fig. 1 Conversions of $H_2$ and $CH_4$ over 2%Pt/MS3A catalyst

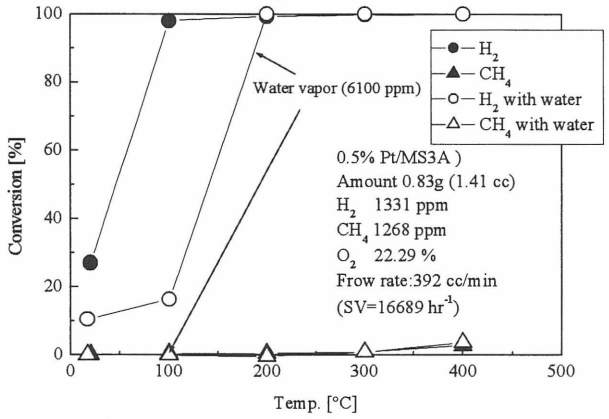


Fig. 2 Conversions of $H_2$ and $CH_4$ over 0.5%Pt/MS3A catalyst

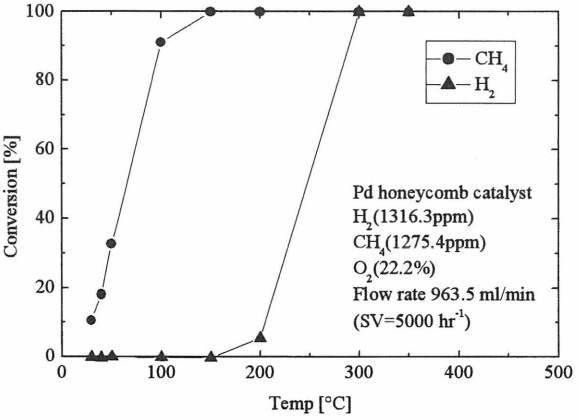


Fig. 3 Conversions of $H_2$ and $CH_4$ over Pd honeycomb catalyst